states).[10] The independent telephone companies, on the other hand, tend to serve several relatively small areas. The telephone independents are similar structurally to the MSOs in the cable industry. The MSOs can be relatively large companies, but these companies tend to serve several relatively small service areas.

28. Appendix 9 examines the relationship between size and return for the telephone industry. The first table presents the size (revenue) and return (after-tax on average common equity and pre-tax on average capital) for the seven RHCs in 1992. The average RHC had revenues of $11.8 billion, a 14.8 percent after-tax return on common equity, a 12.2 percent return on average capital, and an average common equity ratio of 52.5 percent.

29. The second page of Appendix 9 presents these same statistics for the operating companies of six major independents (GTE operating companies are excluded) as follows:

- ALLTEL;
- Central Telephone (CENTEL);
- Century Telephone Enterprises;
- Citizens Utilities;
- Contel; and
- United.

[10] There are exceptions where the independents serve relatively large areas (e.g., GTE operates several large systems).

Two Centel companies are listed as are three United companies. United and Central are subsidiaries of Sprint. Contel has been acquired by GTE. GTE is in the process of selling Contel of New York to Citizens Utilities.

30. The 1992 average return on common equity for the independents was 17.4 percent versus an average of 14.8 percent for the seven RHCs. This higher return cannot be explained at all by leverage because the common equity ratio for the independents is higher than that for the seven RHCs. Also, the seven RHCs and the independents serve the same types of markets. The obvious difference is size. The smaller independents tend to earn a higher return on common equity and on overall capital.

31. The next three pages compare the after-tax returns on common equity for the operating units of the six independent telephone companies for units of differing size. The units are sorted in descending order by number of access lines in 1991. The largest group, with more than 100,000 access lines per unit, had average annual revenues in 1991 of $190.9 million. The average after-tax return on common equity from the operating units in this largest group in 1991 was 17.82 percent. The second group (between 40,000 and 100,000 access lines) had average 1991 revenues of $56.7 million and an after-tax return on common equity of 17.93 percent.

32. The third group (between 14,000 and 40,000 access lines), in 1991, had average revenues of $18.5 million and an after-tax return on common equity of 19.29 percent. Finally, the smallest group (less than 14,000 access lines) had 1991 average revenues of

$7.1 million, average number of access lines of 7,940, and an after-tax return on equity of 20.20 percent.

33. The increase in return on equity as the size of the operating units decline cannot be attributed to differences in capital structure because the common equity ratio (equity as a percent of capital) is as high or higher for the smaller operating units.

34. The results contained in Appendix 9 for the operating units can be summarized as follows:

Operating Units	1991 Average Revenues (Million $)	1991 Average Number of Access Lines (Number)	1991 Average After-Tax Return on Common Equity (%)	1991 Average Pre-Tax Return on Capital (%)	1991 Common Equity Ratio (%)
More than 100,000 Lines	191.9	267,932	17.8	21.2	59.4
40,000 to 100,000 Lines	56.7	68,726	17.9	22.1	60.5
14,000 to 40,000 Lines	18.5	25,050	19.3	22.7	61.0
Less than 14,000 Lines	7.1	7,940	20.2	24.0	64.1

35. The smaller telephone operating units tend to have higher after-tax returns on equity and higher common equity ratios. Therefore, the higher return is purely a reflection of the higher cost of capital to smaller companies.

36. The typical cable system is most similar in size to the smallest group of operating telephone company units (i.e., the units with less than 14,000 access lines or an average number of access lines of 7,940). According to A.C. Nielsen, as of February 1993, there were 11,445 cable systems[11] in the United States with a total of 57,524,490 subscribers, or 5,026 subscribers per system (versus 7,940 access lines for the smallest operating unit group). According to Paul Kagan and Associates, annual 1992 revenues of all cable systems were $21.471 billion or $1.9 million dollars per cable system or $31.11 per subscriber per month.

37. If telephone company results are going to be used by the Commission to provide guidance in setting rates for cable systems, the results obtained by the smallest group of operating units clearly is most relevant. For this smallest group of companies in 1991, the after-tax return on common equity was 20.2 percent while the pre-tax overall return on capital was 24.0 percent.

C. A 86 Percent Debt/14 Percent Equity Capital Structure is Not Reasonable for the Cable Television Industry

38. Dr. Vander Weide's recommendation that the Commission adopt an 86 percent debt and 14 percent equity capital structure is not supported by any theoretical arguments, by any data, or by any analyses. The actual capital structure of the companies Dr. Vander

[11] A.C. Nielsen counts headends which somewhat overstates the number of systems.

Weide analyzes have capital structures consisting of 114 percent debt and a negative equity of 14 percent.

39. The common equity ratios for telephone companies is substantially higher than that for other traditional regulated industries (e.g., electric, gas distribution, and water). Electric utilities typically have common equity ratios in the 40 to 45 percent range instead of the 50 to 60 percent range employed by telephone companies. These higher-than-average common equity ratios can be justified by the higher risks of the telephone industry (the typical RHC has a CAPM beta as calculated by Value Line of about 0.86 while a typical electric utility has a Value Line beta of between 0.60 and 0.65).

40. The cable industry, however, is much riskier than the telephone industry (the CAPM beta for the three "close to pure-play" cable television companies considered above was 1.57 as estimated by Value Line). If the telephone industry justifies a common equity ratio of 60 percent based on its risk, then the cable television industry should be able to justify a common equity ratio of higher than 60 percent based on its risk.

41. The Commission's proposed 50 percent common equity ratio for the cable television industry is a conservative starting point. If rates are set based on this ratio, the actual ratios can move toward this target. As this target is approached, higher ratios can be considered. For cable systems with common equity ratios currently above 50 percent, rates could be set based on their actual common equity ratio.

42. Dr. Vander Weide's recommended 14 percent common equity ratio for the cable television industry has no basis and should not be considered by the Commission.

D. If the 86 Percent Debt/14 Percent Equity Capital Structure Were Used, Then the Cost of Common Equity Would be Much Higher than Estimated by Dr. Vander Weide

43. Dr. Vander Weide's use of the 14 percent common equity capital structure in conjunction with a cost of common equity value calculated for the S&P Industrials that have approximately a 60 percent common equity capital structure is totally inappropriate. Certainly, Dr. Vander Weide knows that the cost of common equity rises dramatically as the common equity ratio falls to relatively low levels (such as the 14 percent common equity ratio used by Dr. Vander Weide for the cable television industry).

44. Appendix 10 presents an excerpt from Financial Management: Theory and Practice by Eugene Brigham and Louis Gapenski. This excerpt discusses the work of Franco Modigliani and Mertin Miller (MM). MM hypothesized that the overall cost of capital was unaffected by the capital structure. Given that debt costs less than equity, this theory implies that the cost of both debt and equity rise as the common equity ratio falls (or as leverage is increased). Brigham and Gapenski summarize the current view of the effects of increased leverage on the overall cost of capital in Figure 11-4 (textbook page 471 and the last page of Appendix 10). Their view is that the overall cost of capital falls as debt is added to a 100 percent equity financial structure until

an optimal point is reached. Past this point, increased leverage (further reductions in the common equity ratio) increases the overall cost of capital.

45. Appendix 11 presents a similar excerpt from Utilities' Cost of Capital by Roger Morin. Roger Morin also presents a figure (see Figure 14-1, page 268 of textbook, 2nd text page of Appendix 11) that shows that increased leverage eventually results in sharply higher equity and debt costs and a rising total capital cost. Dr. Morin's figure suggests that equity and debt costs begin to increase sharply for common equity ratios below 40 percent. Dr. Vander Weide's recommended common equity ratio of 14 percent for the cable television industry is far below 40 percent.

46. Dr. Vander Weide estimates that the after-tax cost of common equity for the third quartile (the quartile with just above average cost of common equity) of S&P Industrials is 15.11 percent (Affidavit at ¶23, p. 14). Assuming this group has approximately the same common equity ratio as all S&P Industrial companies (or 56 percent which was the average common equity ratio over the 1988-92 period), this 15.11 percent return to common equity is appropriate for a 56 percent common equity ratio. However, without any adjustment for the massive difference in leverage, Dr. Vander Weide simply applies the 15.11 percent return to common equity to his assumed cable industry capital structure with only a 14 percent common equity ratio.

47. Appendix 12 presents an article entitled "Capital Structure, Cost of Capital, and Revenue Requirements" by Eugene

Brigham, Louis Gapenski, and Dana Aberwald (BGA Article). Their analysis focused on the change in the cost of common equity if the common equity ratio were reduced from 50 percent to 40 percent. Their analysis concluded that this reduction in the common equity ratio from 50 percent to 40 percent increased the cost of common equity by about 120 basis points or 12 basis points for each percentage point drop in the common equity ratio. However, the relationship was not constant. The drop in the common equity ratio from 50 percent to 49 percent added 7 basis points to the cost of common equity while the drop from 41 percent to 40 percent added 15 basis points to the cost of common equity. Assuming that the increment to the cost of common equity continues to increase with every 10 percent drop in the common equity ratio, the following relationship is established:

Common Equity Ratio (%)	Increment to the Cost of Common Equity per Percentage Point Drop in the Common Equity Ratio	Average Increase in Cost of Common Equity		Cumulative Change in the Cost of Common Equity: 56% Ratio to 14% Ratio
56	7			
		7	x	6 = 42
50	7			
		12	x	10 = 120
40	15			
		22.5	x	10 = 225
30	30			
		45	x	10 = 450
20	60			
		90	x	6 = 540
10	120			
				1377
Total Increase in the Cost of Common Equity Due to Drop in the Common Equity Ratio from 56% to 14%				1377%

Therefore, the BGA article suggests that substituting a 14 percent common equity ratio for a 56 percent common equity ratio would increase the after-tax cost of common equity from 15.11 percent to 28.88 percent. This is a conservative adjustment because it does not assume a sharp acceleration in the relationship between the cost of common equity and leverage as the debt ratio is increased toward 100 percent.

48. If the long-term target capital structure were perceived to be 86 percent debt and 14 percent equity, the debt cost would be higher than the current embedded cost of 7.80 percent. Low-rated 10-year bonds currently are requiring yields in the 10 percent to

12 percent range.[12] Taking the mid-point of 11 percent, the 28.88 percent equity cost, and the 86/14 capital structure, an overall after-tax cost of capital of 13.5 percent would be produced.

E. The Capital Attraction Standard is Broader than Dr. Vander Weide Implies

49. Dr. Vander Weide's interpretation of the capital attraction standard (Affidavit at ¶8, p. 5) is incomplete. In his discussion, Dr. Vander Weide focuses solely on estimating the overall cost of capital for a regulated company. In properly applying the capital attraction standard, one also must examine the adequacy of the estimates of required revenues produced by the estimated overall cost of capital determined by an analyst. Revenue requirements are calculated as follows:

RevReq = (ReqRet) x (RateBase)

where:

RevReq = The revenue (measured in dollars) implied by the required return (ReqRet) and the rate base (RateBase). These revenues are those required to pay interest expenses, to pay income taxes, and to earn a return on equity capital;

ReqRat = The pre-tax overall rate of return (measured as a percentage) which is determined from the

[12] Moody's.

financial analyst's estimates of the cost of debt, cost of equity, the capital structure (i.e., the percentage of debt and equity), and, if the after-tax cost of equity is estimated, the tax rate for business (corporate) income; and

RateBase = The value of the assets (measured in dollars) that are used to provide the regulated service.

50. The formula used to calculate the pre-tax overall rate of return (ReqRate), starting with the after-tax cost of equity, is:

ReqRate = [(DebtShare) x (DebtCostRate)]
+ [(EquityShare) x (After-TaxEquityCostRate)
÷ (1 - (CorpIncomeTaxRate))]

where:

DebtShare = The debt share of debt and equity (percentage);

DebtCostRate = The annual cost of debt stated as a percentage of debt value;

EquityShare = The equity share of debt and equity (percentage) which equals one minus the (DebtShare);

After-TaxEquity CostRate = The annual after-tax cost of common equity stated as a percentage of equity value; and

CorpIncomeTaxRate = The effective federal, state, and local business (corporate) income tax rate (percentage).

51. Dr. Vander Weide recommends that the rate base (RateBase) be limited to the depreciated original cost of the physical assets.[13] I have recommended previously that the invested capital on the books be the initial rate base (RateBase) with a transition to an original cost rate base over a ten-year period.[14] If Dr. Vander Weide's suggestion were accepted, the cable systems that had been purchased during the last five to seven years would not be

[13] In the interest of simplicity of presentation, the issue of apportioning total assets between regulated and unregulated activities is not considered. The implicit assumption is that both Dr. Vander Weide and I have determined the portion of total company assets that would be allocated to the regulated activity (i.e., we both are assuming that a percentage of total assets has been identified that are attributable to the regulated activity).

[14] WhitePaper.

likely to be able to generate sufficient revenues to satisfy the requirements of their creditors.

52. The debt outstanding is matched against total assets of the cable companies. For a cable system that was acquired during or after the mid-1980s, its assets include a substantial percentage of intangibles. If the rate base is defined to include only tangible assets valued at net original cost, this rate base times a reasonable overall pre-tax rate of return (e.g., 19 percent) would not generate sufficient revenues for a such recently acquired cable system.

53. The revenue requirements estimate generated by the rate base rate of return approach must be sufficient to meet the cable system's debt obligations; namely, sufficient revenues must be generated to meet the interest payments. Further, some loans require that revenues are more than sufficient to cover interest payments. Also, if operating income is barely sufficient to meet interest payments, lenders are likely to charge very high interest rates. To avoid having to pay exorbitant debt rates, revenues must be sufficient to afford the lenders confidence that interest payments will be made, and the principle ultimately will be repaid. Such requirements impose so called coverage constraints on the cable systems. These constraints may be stated in terms of a minimum pre-tax interest coverage. The pre-tax interest coverage ratio is defined as pre-tax operating income plus net interest expenses as a ratio to net interest expenses. Minimum pre-tax interest coverage ratios of 1.5 or more are not unusual. A minimum

coverage ratio of 1.5 indicates that there must be sufficient pre-tax income to pay the interest 1.5 times or more. Further, the bond rating groups have minimum pre-tax interest coverage standards as a requirement to obtain an investment grade bond rating (see Attachment 8 for S&P's requirements for telephone companies).

54. One option would be for the Commission to set a minimum pre-tax interest coverage ratio requirement for cable television systems. Based on typical minimum requirements, the lowest reasonable minimum is probably 1.5, with the reasonable range for the minimum being in the 1.5 to 2.5 range. If the cable system can document the need to satisfy a given coverage test, then the system's actual requirements can be used.

55. If the revenue requirement generated by the rate base rate of return analysis does not produce sufficient revenues to satisfy the pre-tax interest coverage constraint, then the revenue requirement should be raised to satisfy the constraint. Rates (prices) for service would be calculated based on the revenue requirement that satisfied the pre-tax interest coverage constraint.

56. There is strong regulatory precedent for setting revenue requirements based on the need to meet minimum debt servicing requirements (e.g., maintain a pre-tax interest coverage ratio above a specified level). The need to set revenue requirements virtually independently of the rate of return analysis generally only arises under extreme special circumstances. Such extreme circumstances certainly would arise if the FCC were to decide to

define the rate base for cable television systems as being equal to the net original cost of tangible assets instead of the depreciated (amortized) value of the tangible and intangible assets currently on the books of these cable systems. If only the original depreciated value of tangible assets is included in the rate base, cable systems will be required by GAAP, as regulated companies, to write-off the value of all assets not included in the rate base.

57. With a rate base equal to an estimate of the depreciated original cost of the tangible assets, the revenue generated by even a generous estimate of the pre-tax overall cost of capital applied to this rate base would not cover interest expenses for cable systems that currently have an asset value substantially above the depreciated original cost of tangible assets. In such a case, the revenue requirements must be set to satisfy the financial obligations of the cable systems. State public utility Commissions have set revenue requirements, and thereby service prices (rates), such that the integrity of securities could be maintained in cases where large nuclear plants under construction were canceled and written off.[15]

58. The analogy is very close between the circumstances facing the cable television industry if they were required to immediately adopt a depreciation original cost rate base (instead of after a 10-year transition period) and an electric utility that

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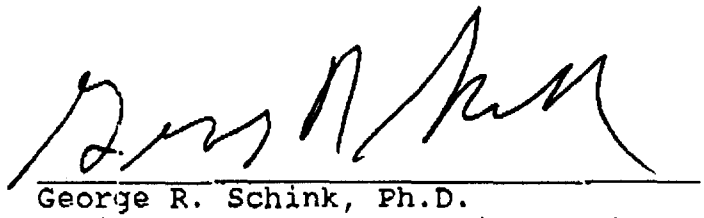
[15]The Michigan Commission established the revenue requirements for Consumers Power in such a manner (Case U-7830, Order Dated Aug. 17, 1984). Also, the Indiana Commission set a dollar revenue requirement for Public Service of Indiana (Case No. 37419, March 7, 1986).

has had to cancel the construction of a largely completed nuclear facility due to an unfavorable decision by its regulators. When the utility commission forces a cancellation of a nuclear plant under construction, the electric utility must write-off the nuclear plant immediately. However, the debt acquired by the electric utility to finance the construction of the nuclear facility is not written off. The interest payments on this debt must be paid and the principle also must be repaid. In such circumstances, the state utility Commissions effectively have used the minimum pre-tax interest coverage ratio to establish revenue requirements. Allowed returns, if reported at all, are determined as the interest coverage determined revenue requirement divided by the rate base. Also, if a nuclear facility is written off, the write-off comes out of equity which produces a very low equity ratio for the electric utilities. For cable television systems, adopting a depreciated original cost rate base, as recommended by Dr. Vander Weide, would eliminate all existing equity.[16]

[16]Asnoted earlier, some cable companies already have negative equity.

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct. Executed on the 13th day of September, 1993.



George R. Schink, Ph.D.
Chairman & Chief Executive Officer
AUS Consultants
West Conshohocken, PA 19428

APPENDIX 1

RESUME OF DR. GEORGE R. SCHINK

GEORGE R. SCHINK, Ph.D.
Chairman, Chief Executive Officer
AUS Consultants
Industry Analysis Group
200 Four Falls Corporate Center - Suite 308
West Conshohocken, PA 19428

PROFESSIONAL EXPERIENCE

AUS CONSULTANTS, INDUSTRY ANALYSIS GROUP, West Conshohocken, PA

Chairman and Chief Executive Officer — 6/88-Present

Responsible for overall management and strategic guidance of the Industry Analysis Group, as well as the design and execution of consulting projects related to the automotive, energy, utility, and telecommunications industries. These projects include market analysis, development of sales volume and revenue models, development of price and cost models, industry studies, and analysis of the impact of government policy and regulatory changes on these industries. The results of these studies are provided to clients as reports and in direct presentations to senior management. Also, Dr. Schink has extensive experience in presenting testimony before regulatory bodies and in the courts.

THE WEFA GROUP (Wharton Econometrics), Bala Cynwyd, PA

Senior Vice President, Consulting Services — 5/87-5/88
Vice President, Research and Development — 6/83-5/87

Responsible for the development, enhancement, specification, maintenance of the Wharton econometric models. Also responsible for design, execution, and economic content of large contract research projects, preparation and presentation of testimony, general quality control of Wharton economic analysis and forecasting products, internal training of economic staff, and design inputs for econometric and statistical software.

Key contract research projects include an analysis of the macroeconomic impacts of local content legislation and an analysis of the economy-wide effects of the FCC access charge plan. Major model development projects include a redesign of Wharton's multiregion model of New York State and respecification and updating of Wharton's Quarterly Model.

Vice President, U.S. Modeling Services — 1/80-6/83

Responsible for coordinating model development/enhancement activities of Wharton's U.S. forecasting services, including the Long-Term Forecasting Model, the Quarterly Forecasting Model, and Industry Planning Service Model.

Worked with the marketing group and the model project directors to develop new sources of revenue for the U.S. model-based forecasting services from both subscription and contract research sources.

Executive Director, Wharton Annual (Long-Term) Model Project 1/77-12/79

Responsible for directing model development/enhancement, forecasting, scenario analysis, contract research, forecast review meetings, and client support activities for U.S. Long-Term Forecasting Service.

Under the direction of Dr. Schink, the Wharton Annual Model was expanded in scope (from 850 variables to 2300 variables) to incorporate energy detail, demographic detail, and producer price detail. These changes were designed to enhance the Annual Model's usefulness for long-term planning and analysis. Research and development contracts to support the Long-Term Model enhancement activities were obtained from the Federal Energy Administration, the Electric Power Research Institute, the Office of Naval Research, Ross Laboratories, and the U.S. Department of Energy.

These model enhancement activities have led to contracts to perform long-term policy and scenario analyses for the groups supporting development as well as contracts from others such as the American Gas Association, the Whirlpool Corporation, the New York Stock Exchange, the General Accounting Office, the Joint Economic Committee, the U.S. Department of Commerce, Sun Oil Company, and the U.S. Department of Defense.

Executive Director, Special Projects 6/72-1/77

Directed the Commodity Model Maintenance Project (a joint effort with Charles River Associates, Inc.). This project involved the development of econometric models of the world markets for nonferrous mineral commodities. These models were used to produce five-year projections of demand, supply, and price, and to evaluate the effects of alternative General Services Administration commodity disposal patterns on these commodity markets. Over a four-year period, twelve markets were analyzed: Cobalt, Copper, Chromite, Lead, Manganese, Mercury, Molybdenum, Platinum-Palladium, Rubber, Tin, Tungsten, and Zinc.

Developed a regional econometric model of Luzerne County, Pennsylvania, to evaluate the effects of Hurricane Agnes on this area.

Developed a large model of the U.S. auto industry based on time-series and cross-section data. This model, which was developed for the Transportation Systems Center of the U.S. Department of Transportation, was designed as a tool to investigate the longer-term determinants of the size and composition of the U.S. auto fleet and to provide a tool for the analysis of various potential policy initiatives.

Developed a model based on cross-section data for the National Association of Broadcasters to analyze the effects of increasing the number of imported signals carried via cable systems on the audience for local stations.

Participated in the development of Wharton's timesharing software system. Dr. Schink was involved in the selection of a time-sharing vendor, assembly of the programming staff, specification of the software capabilities, the incorporation of Wharton data bases and models in the new software system, the development of documentation and the initial marketing effort.

Participated in the design of the Wharton World Model system.

UNIVERSITY OF PENNSYLVANIA, Philadelphia, PA — Spring '73
Visiting Lecturer

THE BROOKINGS INSTITUTION, Washington, D.C.

Principal Investigator, Quarterly Model Project — 6/69-6/72

Responsible for directing the staff of the model project with guidance from senior advisors (primarily Lawrence R. Klein and Gary Fromm).

Specified and estimated the version of the Brookings Model which was used to perform analyses presented at the Conference on Research in Income and Wealth, Harvard University, November 1969.

Constructed a condensed version of the Brookings Model to study the gains and losses in simulation and forecasting accuracy associated with disaggregation of econometric models.

Organized a major conference devoted to a review of econometric model building, the contributions of the Brookings Model project, and the perspective for future developments, held in Washington, D.C. during February 1972.

UNIVERSITY OF MARYLAND

Lecturer, Department of Economics — 9/68-6/72

Taught full-time during the 1968-69 school year and part-time (one course per semester) thereafter.

Courses taught include microeconomic theory, macroeconomic theory, mathematics for economists, and econometrics at both the undergraduate and graduate levels.

MATHEMATICA, Princeton, N.J.

Consultant — 10/67-6/68

Worked on the Northeast Corridor Project studying the determinants of travel between city-pairs.

UNIVERSITY OF PENNSYLVANIA, Philadelphia, PA

Research Fellow, Economic Research Unit — 9/65-8/68

Worked for Lawrence R. Klein on the Wharton Quarterly Model Project. Under his direction, reestimated the entire model, developed computer software to solve the model, and mounted the model on a timesharing system.

Worked for Phoebus Dhrymes on several studies. Functioned as a programmer in implementing various distributed lag estimation techniques (search technique and spectral analysis technique) and estimated equations using three-stage least squares for a study of corporate investment, dividend, and borrowing policies.

Worked for Edwin Burmeister and F. Gerard Adams on several projects.

EDUCATION

Ph.D. in Economics, University of Pennsylvania, 1971

Thesis (Unpublished): Small Sample Estimates of the Variance Covariance Matrix of Forecast Error for Large Econometric Models: The Stochastic Simulation Technique. Won William Carey Prize for best Ph.D. thesis in economics at the University of Pennsylvania, 1971. Thesis Advisor: Professor Lawrence R. Klein

B.S. in Economics, University of Wisconsin at Madison, 1964

PROFESSIONAL HONORS AND ASSOCIATIONS

Board of Directors, Wharton Econometric Forecasting Associates, 1972-87.
William Carey Prize for Best Thesis in Economics, U of PA.
Ford Foundation Dissertation Grant, 1967.
Research Fellowship, Economic Research Unit, University of PA.
Member, American Economic Association & the Econometric Society.

PUBLISHED ARTICLES

"Short and Long Term Simulations with the Brookings Model" (with Gary Fromm and Lawrence R. Klein), in Bert G. Hickman (ed.) Econometric Models of Cyclical Behavior, New York: Bureau of Economic Research, 1972.

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"An Overview of Econometric Model Building In And Of the U.S.A.: Subnational Macro Econometric Modeling," published in Proceedings of the NSF-CNRS Conference on Macroeconometric Models and Economic Forecasting, Universite de Paris, X-Naterre, November 22-26, 1976.

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RESEARCH REPORTS, CONFERENCE PRESENTATIONS AND TESTIMONY

"Estimation of Forecast Error in a Dynamic and/or Non-Linear Econometric Model," presented at the Econometric Society Meetings, Evanston, IL, December 1968.

"Simulation with Large Econometric Models," presented at the ACM Summer Meetings, Denver, CO, June 1970.

Nonferrous Mineral Commodity studies prepared for the Office of Stockpile Disposal of the General Services Administration (jointly with various staff members at Charles River Associates).

Forecasts and Analysis of the Molybdenum Market, 12/72
Forecasts and Analysis of the Mercury Market, 3/73
Forecasts and Analysis of the Lead Market, 6/73
Forecasts and Analysis of the Zinc Market, 7/73
Forecasts and Analysis of the Cobalt Market, 3/74
Forecasts and Analysis of the Tungsten Market, 6/74
Forecasts and Analysis of the Lead Market, 5/75
Forecasts and Analysis of the Tungsten Market, 9/75
Forecasts and Analysis of the Manganese Market, 10/75
Forecasts and Analysis of the Mercury Market, 11/75
Forecasts and Analysis of the Manganese Market, 11/76

An Econometric Model of Luzerne County, prepared for the Department of Commerce, Commonwealth of Pennsylvania, June 1974.

An Analysis of the Automobile Market: Modeling the Long-Run Determinants, 3 Volumes (with Colin Loxley), prepared for the U.S. Department of Transportation, Transportation Systems Center, Cambridge, MA, February 1977.

"Financing the Energy Program" (with Lawrence R. Klein and Richard M. Young), testimony before the Subcommittee on Administration of the Internal Revenue Code of the Committee on Finance, U.S. Senate, June 6, 1977.

"The Oil Equalization Tax" (with William Finan), testimony before the Committee on Energy and Natural Resources, U.S. Senate, September 16, 1977.

The Impacts of Cable TV on Local Station Audience (with Sheela Thanawala), prepared for the National Association of Broadcasters, 1771 N Street, N.W., Washington, D.C. 20036, March 1978.

Analysis of the Macroeconomic Impacts of the Proposed NHTSA Passenger Car MPG Standards, prepared for the Chase Manhattan Bank, N.A., 1 Chase Manhattan Plaza, New York, N.Y. 10015, January 1979.

"U.S. Economic Prospects for the Next Ten Years," The Wharton Magazine, Winter 1979.

Simulation Study of Eight Petroleum Supply Disruption Scenarios, prepared for the Macroeconomic Analysis Division of the Energy Information Administration, U.S. Department of Energy, April 1979.

"Input-Output in the Context of the Wharton Annual Model "(with Gene D. Guill and Yacov Sheinin), Wharton Annual Model Working Paper Number 6, April 1978. Presented at the Seventh International Conference on Input-Output Techniques, Innsbruck, Austria, April 1979.

"Optimal Control and Macroeconomic Models," a paper prepared as part of a study entitled Mexico--Economic Policy Analysis--1978/1983: A Macroeconometric Model of Mexico and Control Theory Applications, by Oscar Adolfo Rufatt, under a grant from the Inter-American Development Bank, May 1979.

"Integration of Neoclassical Production Function Theory and Input-Output Matrices" (with Gene D. Guill and Yacov Sheinin), presented at a Seminar on Production Functions at the U.S. Department of Energy, May 21, 1979.

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